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X BRUCELLOSIS CONTROL AND ERADICATION X

By B. T. Simms¹

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Brucellosis continues to be one of the most serious and widespread of all the infectious diseases which occur among livestock in the United States. Among the 1,321,445 cattle officially tested in this country during the first 3 months of 1947, 58,525 or about $4\frac{1}{2}$ percent were reactors. They were distributed among 21,257 or nearly 20 percent of the 109,224 herds which were tested. There was an average of about 21 cattle tested in each infected herd and about 3 reactors to a herd. There are probably about one and a quarter million infected dairy cattle in this country.

We are interested in brucellosis control and eradication in our dairy herds for two reasons. One is the danger of human infection; the other is the economic loss which is caused by this disease. We feel very strongly that the economics of brucellosis has not been either studied or emphasized as much as it deserves. Although it is generally agreed and is supported by data that brucella-infected cows produce fewer live calves, have more retained placenta, more breeding trouble, more arthritis and more mastitis, and give less milk than do cows free from this disease, there are relatively few research workers who have made extensive studies of these results. Huddleson has summarized 7 papers which compared a total of 560 lactation periods in brucella-infected cows with 821 lactations in brucella-free cows which served as controls. The infected cows produced an average of 6,563 pounds of milk per lactation period or 23 percent less than the controls, which gave an average of 8,626 pounds. These data support the general observation that brucella-infected cows are usually not profitable.

Either the human health hazard or the economic loss associated with this disease is of enough importance to make it advisable that we rid our herds of this infection. The combination of the two makes it mandatory that this be done. If we dairy-men, veterinarians, and livestock sanitary officials do not move forward with a satisfactory control and eradication program it is very probable that we shall see considerable pressure developing among consumer groups. Such pressure may not be well directed and will quite possibly lead to friction and misunderstanding.

What shall our program be? We believe the only one we can defend must promise freedom from brucellosis. Both the sanitary officials and the dairymen must cooperate in formulating such a program if it is to succeed with the least

¹/ Dr. Simms is Chief of the Bureau of Animal Industry, Agricultural Research Administration, United States Department of Agriculture

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possible economic disturbance. It is the veterinarian's job to furnish the technical information on control methods. The dairyman must adopt, with the veterinarian's advice and consent, the procedures which are specially applicable and necessary to his herd and farm. In many instances, counsel of an expert in the field of dairy-farm management is needed in formulating the best plan. When such counsel is available it is usually possible to devise procedures which if carefully followed lead to eradication without seriously decreasing income from the herd and farm.

Basic Facts

Certain well-established facts are basic to understanding the brucellosis control and eradication program. Among these are:

1. The infected cow or heifer is the principal source of infection. Such animals are specially dangerous at the time of calving or aborting, as large numbers of *Brucella* organisms may escape from the uterus at that time. Milk from infected cows may contain the organisms.
2. No successful method of treating the disease has been found.
3. The agglutination test is an accurate but not perfect method of diagnosis.
4. Heifers under 10 to 12 months' old are quite resistant to the infection, but they become more susceptible when they reach breeding age. Pregnant heifers and milking or pregnant cows are easily infected.
5. Six to 8 months' old heifers usually develop good resistance, but not complete immunity following vaccination with Strain 19 vaccine. This resistance decreases somewhat with time. A few (up to 5 percent) of vaccinated heifers may become permanent reactors.
6. Non-infected heifers of breeding age and cows also develop marked resistance following vaccination. A fairly high percentage of animals of this category become permanent reactors to the agglutination test after vaccination.
7. No method of differentiating between reactions which follow vaccination and those which follow infection with virulent *Brucella* organisms has been found.
8. Vaccination has not been shown to have any curative properties.
9. All available evidence supports the statement that injection of Strain 19 vaccine does not set up a transmissible infection.

It is evident from these facts that there may be two methods of approach in controlling and eradicating bovine brucellosis. One is by controlling the infected cattle so that the disease-free animals will not be exposed. This is the method which has been used in the fight against such diseases as tuberculosis, glanders, pullorum disease, and contagious pleuropneumonia. The other is by increasing resistance to the disease by vaccination. This procedure has been used in handling anthrax, blackleg, hog cholera, encephalomyelitis, and fowl pox. The Bureau of Animal Industry has long recognized both the merits and the shortcomings of these two approaches.

Plans for Controlling and Eradicating Brucellosis

The following methods have been followed in the field in infected herds:

A. Test and slaughter of reactors. This method is time-tried, having been in use in the United States for more than 25 years. Thousands of brucellosis-free herds have been established by following it. Unfortunately, though, too many people have thought that the title of this method included all that needs to be done. Immediately following the removal of reactors any barns and shelters to which infected cattle have had access should be thoroughly cleaned and disinfected. Retests should be at close enough intervals to detect any recently infected animals before they calve or abort. Sound management methods which include either raising all the females needed for replacements or the exercise of the greatest care in buying them are a necessary part of this program. Calf-hood vaccination may or may not be used in these herds. If the method is successful the herd will be free of brucellosis before any of the vaccinated heifers become replacements. However, if it develops into a so-called problem herd and does not respond satisfactorily to the test-and-slaughter method the vaccinated heifers will undoubtedly prove very valuable. Furthermore, the vaccinated heifers will be quite resistant if infection is introduced at some later date.

Naturally, owners of infected herds are concerned over the final economic effects of this program. Many believe that the financial losses which will result will be so great that the procedure cannot be justified. Some may say that they are willing to get rid of the reactors found on the first test if they can have some assurance that subsequent tests will not continue to reveal reactors until a high percentage of their herd has been removed. Of course, no definite promises along this line can be made, but available data show that, in the average herd, owners can expect that the total number of reactors removed during the clean-up program will not be more than twice the number found on the first test.

In many instances, owners have observed that the reactors included most of their shy breeders and cases of chronic mastitis. They have realized that such reactors were low producers and that their removal would not cause a serious financial strain.

On some farms, it has been possible to change the management program slightly in order to keep the income up near its normal level until replacement heifers could reach milking age. Increasing the size of the swine, poultry, sheep, or beef unit has been a satisfactory solution on many of these. Others have marketed some of the grain which ordinarily would have been fed to dairy cattle. Such shifts have been difficult when milk quotas had to be met or in areas unsuited to any other type of farming than dairying. In general, dairymen have been well pleased with results which have followed these management changes.

The test-and-slaughter method has usually not been successful unless owners understood the program and were willing to cooperate. Every veterinarian who has worked with brucellosis can cite instances of reinfection which have followed the introduction of untested cattle into herds which have been freed of the disease. It should be a definite part of the educational work to impress owners with the necessity of following to the letter the sanitary measures which are laid down by the State and the Federal authorities. It has not been very successful in large purebred herds if the owners follow the practice of buying and introducing cows and bred heifers quite frequently. Such a practice is too apt to result in infection, even though the purchased animals are tested.

B. Test with segregation of reactors. This method consists of separating the reactors and non-reactors and maintaining them as separate herds. If feasible, the non-reactors should be removed from the infected premises to clean quarters. It cannot be emphasized too strongly that the reactors should be permanently identified and held in quarantine on the farm until they go to slaughter. All milk from the reactor group should be pasteurized. The retention of reactors in segregation should be recommended and adopted only on those farms which can have very close supervision under high-quality management. Every effort should be made to reduce the size of the infected herd as rapidly as possible consistent with the breeding and management program, because as each infected cow goes to the butcher one possible source of infection is permanently removed from the premises. Calfhood vaccination should always be recommended on farms which adopt this method, as there is great danger of exposing the negative animals as long as any infected cattle are kept.

While this method is not applicable to a high percentage of the farms, it does offer a possibility of keeping for breeding purposes infected cows of superior blood lines. In many

instances, owners sell their reacting cattle very soon after they are segregated, as such groups usually have so much breeding trouble and mastitis, so many abortions, and produce such a small quantity of milk that they are unprofitable.

C. Test with retention of reactors and calfhood vaccination. This method has been widely used in heavily infected herds in which neither of the previously outlined methods seemed applicable. It has been popular with owners of such herds who have certain milk quotas to meet, with those who purchase a part of their replacements, with those whose herds are surrounded by infected herds, and with those whose farms do not lend themselves easily to a change to some other enterprise as a substitute for a part of the dairy herd. In herds under this program, the infected animals should be permanently identified and should be held under quarantine. All milk from such herds should be pasteurized.

Perhaps this method has been the least understood and the most abused of all those which have been adopted. In many herds, nothing else than vaccination of calves has been done to prevent the spread of the disease. Consequently, the infection has continued to spread rapidly in the unvaccinated animals of breeding age with the usual economic losses. Low production has forced more than one dairyman out of business before his vaccinated heifers were old enough to add to the milking string.

The final aim of this method should always be a brucellosis-free herd which is to be established by replacing the infected cows with disease-free vaccinated heifers. Good management is a necessity if this result is to be obtained. During the period that the infected cattle are held--and this should not be longer than 4 to 5 years--every precaution should be taken to prevent infection of the disease-free cows in the herd. Since infected cows are usually quite dangerous at the time of, and for a short while after, aborting or calving they should receive close attention at this time. Regular observations of all pregnant females should be made, and any that show signs of impending abortion or calving should be isolated immediately. Separate maternity stalls or corrals should be provided for the infected cows. Placenta from infected cows and any aborted or dead calves should be buried or burned. Caretakers handling infected animals at the time of calving or aborting should be very careful not to carry infection on their hands, shoes, or clothing to the negative animals. Every infected cow should be thoroughly washed with a satisfactory antiseptic solution immediately after she is taken from the maternity stall or corral and before being placed back in the herd. On some farms, reactors which have calved normally have not been bred again. This lengthened the lactation period materially and removed the danger of an unexpected abortion. At least one veterinarian has spayed some reacting cows and has claimed that they continued in good

production for a very long period.

On every farm where reactors are held it is advisable to stanchion them together and to reduce to a minimum their direct contact with the healthy cattle. Low-producing reactors should always be sold to the butcher at the earliest possible time.

D. Whole-herd vaccination. In problem herds and in those in which storms of abortion are occurring, and which are on premises which do not lend themselves to even partial segregation, this method has been used. It has not been and is not recommended by the Bureau for adoption in any dairy herd in which any one of the other methods will probably succeed. Whole-herd vaccination cannot be expected to control a storm of abortion immediately.

Since positive agglutination reactions which follow vaccination persist in a high percentage of vaccinated cows, it is impossible to use the agglutination test in determining which females in vaccinated herds may be possible sources of danger to both people and susceptible cattle. These persistent reactions block any attempt at immediate control and eradication based on the agglutination test. Furthermore, at least some of the cows which are vaccinated in the last half of pregnancy may abort from Strain 19. Since a fourth to a third of the cows in the average market milk herd are in the last half of pregnancy at any given time it is evident that entire-herd vaccination may be slightly dangerous. Cows or heifers aborting from vaccination apparently are not spreaders of brucellosis. The loss, then, from such abortions is restricted to the aborting animals. It is rather generally recommended that cows in the last half of pregnancy be held in isolation and that vaccination be delayed until they have freshened.

Before whole-herd vaccination is used in any group of females, full consideration should be given to any State or municipal laws or ordinances which might interfere with the sale of milk or other dairy products from reacting cows. Written permission should be obtained from the State livestock sanitary authorities before mature animals are injected with vaccine.

E. Calfhood vaccination without testing. This procedure has been used to some extent in beef herds. It is difficult to justify its adoption in any dairy herd, as a sound herd-management program cannot be set up unless the status of the cows in the herd is known.

What about the program in the approximately 80 percent of the herds in the United States which are free of brucellosis? In many States and areas too little attention has been paid to this group. The well-known fundamental procedures for

prevention of infectious diseases must be followed in protecting these herds. Purchases or introductions of female cattle, which should be held to a minimum, should be from brucellosis-free herds. Heifers which have not reached breeding age should always be given preference as additions to these herds, as they are least apt to introduce infection. Any possible contacts with infected or untested cattle in pastures, sales yards, etc., must be avoided. Trucks which have been used for hauling diseased or untested cattle should be thoroughly cleaned and disinfected before they are allowed on the premises.

Many veterinarians and livestock owners have recommended and practiced calfhood vaccination on brucellosis-free farms, believing that this gives added protection. This recommendation has been made especially if infected cattle were known to be on immediately adjacent premises or if the percentage of infection in the area was known to be high. Unfortunately, many owners have developed a false sense of security following vaccination of their heifers. This has led them to neglect all sanitary precautions. In some instances, disaster has followed such an attitude. It cannot be emphasized too strongly that vaccination is not to be used as a substitute for sanitation.

Discussion

In those States in which brucellosis control and eradication have made most progress there has been good cooperation among the people concerned, including State veterinarians, Federal veterinarians, extension workers, State, county, and municipal health officers, and practicing veterinarians. The dairymen naturally look to these groups for advice and leadership. If there is indifference toward or criticism of the program from any of them the dairymen are confused and bewildered. It cannot be stressed too strongly that the officials and leaders should be in agreement before any program is recommended.

So far we have considered only the individual farm. Long experience has taught farm leaders that programs succeed best when they are set up on a community or area basis. Brucellosis eradication is no exception. There are several reasons for this. One is economy of time and effort on the part of the veterinarians doing the field work. It is difficult for any State or Federal official to justify the assignment of personnel to work with widely scattered individual herds when the same personnel can accomplish so much more by working on an area plan. The probability of reinfection after herds are freed of the disease is materially less if the area-control program is under way. Owners of brucellosis-free herds usually give active support to area eradication because it lessens the probability of introduction of the disease to their farms. Furthermore, the area plan

offers a definite commercial advantage to those dairymen who have cattle for sale, as buyers wanting disease-free animals are attracted to such sections.

It seems logical for any State to concentrate its efforts at the beginning of a brucellosis campaign in counties and sections which produce an excess of cattle. When these are relatively free of the disease they can serve as a source of replacements for milk-shed herds which normally do not raise enough heifers to keep their stanchions filled. Attention is called to the serious difficulty experienced in establishing and maintaining tuberculosis-free herds in the large milk sheds before the breeding areas which furnished replacements were cleaned up. This same observation has been made in the fight against brucellosis.

We would not minimize the difficulty facing us in the fight against brucellosis. It will be long and hard and will require all of our ingenuity. Progress has in some instances been disappointingly slow, but enough herds, areas, and counties have been freed of the disease to prove that the job, big though it is, can be done.

Summary

1. Brucellosis continues to be one of the most serious of our livestock diseases.
2. Freedom from this disease should be the goal of all control programs.
3. Any control and eradication program must be based on full and intelligent cooperation between the veterinarians and the managers of the herds concerned.
4. Either slaughter or quarantine of infected cattle must be a part of any successful program.
5. Strain 19 vaccine is a valuable adjunct to, but not a substitute for, sound sanitary measures.
6. Owners of herds now free from brucellosis should exercise every precaution to prevent its introduction.